REMARKS

Claims 1-22 are pending in the present application and each has been finally rejected. Claims 12, 14, 15, 17, 18 and 22 are amended herein. Applicants respectfully request re-examination, reconsideration and allowance of each of pending claims 1-22.

First and foremost, Applicants take this opportunity to thank Examiners Norton and Knight for the opportunity given Applicants' undersigned counsel, Mark J. Marcelli, to discuss aspects of the claimed invention with the Examiners in telephonic Examiner interviews that took place on February 7 and 9, 2007. No agreement was reached with respect to the pending claims in those interviews.

Applicants also thank Examiner Norton for the detailed analysis provided on the Continuation Sheets that supplemented the Advisory Action issued on December 4, 2006.

Claim Amendments

Claims 12, 14, 15, 17, 18 and 22 have been amended to correct typographical errors. The word "criteria" has been replaced with the word "critical" in each instance.

Claim Rejections under 35 U.S.C. § 102(b) and 35 U.S.C. § 103(a)

The Action dated August 23, 2006 rejects Claims 1-4, and 9-11 under 35 U.S.C. § 102(b), contending that the claims are anticipated by U.S. Patent No. 5,409,538 to Nakayama et al. ("Nakayama"). The Action also rejects Claims 5-8, and 12-22 under 35 U.S.C. § 103(a), contending that the claims are unpatentable over Nakayama in view of U.S. Patent No. 6,789,529 to Saka et al. ("Saka"). Applicants respectfully submit that these claims rejections are overcome for reasons set forth below.

Briefly and in summary, the claimed invention, specifically independent claims 1 and 12, is distinguished from the references of record because the claimed invention is directed to using signals based on critical dimension measurements and the references do not teach or

suggest this. The claimed signals are feedback process control signals that control exposure energy directed to a substitute.

* Applicants respectfully submit that it is absolutely uncontroverted in the art that a *critical dimension* measurement is necessarily made from a *patterned* wafer. Inherent with a critical dimension is a patterned layer.

* Applicants respectfully submit that it is inherent in "signal of critical dimension" (claim 1) that a measurement and/or recordation of the CD has taken place since the critical dimension -- a physical dimension of a feature -- is carried within or embodied by the signal. Alternatively stated, a signal "of critical dimension" necessarily contains information on the dimension or physical measurement of the CD itself. Clearly, the same is true for a "signal . . . based on critical dimension measurement" (claim 12).

Critical Dimensions, or "CD's"

One of ordinary skill in the semiconductor art knows that the expression "critical dimensions" or "CD's," is a term of art well known and long used in the semiconductor industry and not simply two words to be interpreted separately. One of ordinary skill in the semiconductor art further knows that CD's refer to dimensions of geometrical features, i.e., patterned features. Without a pattern, there can be no CD's. An unpatterned layer has no CD's. A ***critical dimension*** may be a width, length or spacing of features that are formed in a ***patterned*** layer. A blanket layer of material has no CD's.

Applicants provide herein and attach hereto three reliable sources known to those in the semiconductor art, to support the fact that a critical dimension refers to a geometry of a patterned feature in a semiconductor device, not an unpatterned layer used in the manufacture of a semiconductor device: 1] http://www.semiconductorglossary.com/, as visited on 18 October 2006 and which provides that a CD, critical dimension, is a "term related to the geometry of features of an integrated circuit." 2] Wolf, Silicon Processing for the VLSI Era, Volume 1, also attached, defines CD on page 532 in the section on Linewidth Variation and

Control as: the absolute size of a minimum feature, including linewidth, spacing or contact dimensions. 3] The Sematech online dictionary, http://www.sematech.org/publications/dictionary, as visited on 15 February 2007, defines critical dimension as "the width of a patterned line or the distance between two lines, monitored to maintain device performance consistency; that dimension of a specified geometry that must be within design tolerances."

Applicants respectfully submit that the definitions provided above clearly support that one of ordinary skill in the semiconductor art, knows that a critical dimension is a dimension of a patterned geometrical feature and that a blanket unpatterned layer or film does not have CD's. In particular, the reflectivity, refracted index, transmittance, polarization, spectral transmittance, and thickness of a blanket layer are simply not CD's.

Claim Rejections under 35 U.S.C. § 102(b)

As above, Claims 1-4 and 9-11 were rejected under 35 U.S.C. §102(b) as being anticipated by Nakayama. Applicants respectfully submit that these claim rejections are overcome for reasons set forth below.

Claim 1 recites "controlling the exposure energy with a feedback process control signal of critical dimension, and further controlling the exposure energy with a feed forward process control signal of a compensation amount that compensates for wafer thickness variations."

Applicants respectfully submit that Nakayama fails to teach or suggest the claimed features recited in independent Claim 1. Claims 2-4 and 9-11 depend from claim 1.

Nakayama is limited to using an unpatterned wafer and therefore cannot and does not use any critical dimension measurements, much less utilize feedback or feed forward signals based on critical dimension measurements. Nakayama is directed to a method of irradiating a substrate with light to measure variations in **optical properties**, such as reflectivity, refractive index, transmittance, polarization and spectral transmittance, for providing data for controlling a film formation or film treatment process via a feedback or feed forward signal (see Abstract).

Nothing in Nakayama teaches using a signal of critical dimension, much less controlling an exposure energy with a feedback process control signal of critical dimension (CD).

In paragraph 6, the Office Action alleges that Col. 6, Lines 14-21 and 48-55, Col. 15, Lines 12-21, and FIG. 18 describe "controlling the exposure energy with a feedback process control signal of critical dimension." This is not so. Column 6, lines 14-21 refer back to "the optimum exposure energy so obtained" and such is determined according to the preceding paragraphs in columns 5, 6 by measuring optical properties such as Index of Refraction, spectral transmittance and irradiation illumination. Column 6, lines 48-55 teaches measuring reflectivity, Index of Refraction and irradiation illumination. None of these optical properties are CD's as none relate to a dimension of a patterned geometrical feature. Column 15 and FIG. 18 refer to the data transferred from optical property measuring system 56 through interface 101 to process controlling system 45 as the feedback signal. Optical property measuring system 56 collects optical properties of an unpatterned photoresist layer. Optical properties generally include reflectivity, refractive index, transmittance, polarization, and spectral transmittance, and are collected from plain, unpatterned surfaces of material layers. As above, these are not CD's from a patterned layer. Nakayama therefore does not teach this "feedback process control signal of critical dimension" feature. Nakayama also fails to suggest this feature of the feedback process control signal of critical dimension. Claim 1 is therefore distinguished from Nakayama.

Accordingly, Applicants submit that Claim 1 is distinguished from Nakayama and therefore allowable for at least the reasons set forth above. Claim 2-4 and 9-11 depend from Claim 1 and are also allowable for at least reasons set forth above in connection with Claim 1.

Based on the foregoing, the §102(b) rejections should be withdrawn.

Claim Rejections under 35 U.S.C. § 103(a)

Claims 5-8 and 12-22 were rejected under 35 U.S.C. §103(a) for being unpatentable over Nakayama in view of Saka. Applicants respectfully submit that these claim rejections are overcome for reasons set forth below.

Claims 5-8 depend from Claim 1. Claim 1 is distinguished from Nakayama for reasons set forth above. With respect to dependent claims 5 and 6, Saka has apparently been relied upon for providing measurement of a remaining thickness of a planarized interlayer. Thickness is not a CD, as above. Saka measures thickness using reflectivity. Saka therefore does not make up for the above-stated deficiencies of Nakayama and the rejection of claims 5 and 6 should therefore be withdrawn. Claims 5 and 6 are distinguished from the references of Nakayama and Saka, taken alone or in combination.

With respect to dependent claims 7 and 8, independent claim 12 and claims 13-22 which depend from claim 12, the Action alleges that Saka "teaches to a critical dimension measurement of a top layer of a wafer substrate of a previous manufacturing lot (col. 6, lines 58-60, col. 9, lines 28-33 and col. 12, lines 32-35)" subject Office Action, page 9, lines 1-3. Saka absolutely does not teach using CD measurements of any nature.

The column 6 excerpt merely recites the use of an optical endpoint detection system. The column 9 excerpt refers to the factors which indicate the reflectance of the optical signal and the excerpt in column 12 teaches using a pressure profile from one wafer to control the next wafer. Nothing in these sections teaches or suggests the feature recited in independent claim 12:

> a feedback controller providing a feedback exposure energy control signal to the exposure apparatus based on critical dimension measurement of a top layer of a wafer substrate of a previous manufacturing lot.

An optical endpoint detection system such as disclosed in Saka relies upon the changes in an optical signal that go through an upper film layer and are reflected off of a subjacent layer. In particular, the system of Saka relies upon "the differences in reflectance" and provides means for monitoring the reflected light. The optical signal measured in Saka is reflectance. Reflectance is not a critical dimension. Saka therefore does not provide the feature of providing a feedback exposure energy control signal . . . based on critical dimension measurement of a top layer of a wafer substrate of a previous manufacturing lot." The Office Action expressly concedes, on page 8, last paragraph, that Nakayama also does not teach this

feature. In addition, as for reasons presented above in connection with Claim 1, the list of optical properties described in Nakayama does not include any critical dimension measurement, much less a critical dimension measurement of a top layer of a wafer substrate of a previous manufacturing lot. Dependent claims 7 and 8 and claims 12-22 are therefore distinguished from the references of Nakayama and Saka, taken alone or in combination, and therefore the rejection of claims 7-8 and 12-22 under 35 U.S.C. § 103, should be withdrawn. It is submitted that Claims 7-8 and 12-22 are not obvious over the art of record and are therefore allowable for at least reasons set forth above.

Applicant's Response to Examiner's Comments In 12/04/2006 Advisory Action

Applicants thank the Examiner for the detailed analysis that appeared on the Continuation Sheets of the December 4, 2006, Advisory Action. The first eight paragraphs of the Continuation Sheet (page 2 of the Advisory Action) suggest that Nakayama provides feed forward, feedback process control signals and refer to columns 1 and 6, and column 15, of Nakayama. Applicants again point out that the teachings in columns 1 and 6 of Nakayama, cited on the Continuation Sheet, are directed to thin film formation processes in which optical properties are measured and used. With respect to the teachings in column 15 of Nakayama, and which refer to Fig. 18, these excerpts of Nakayama teach using the optical properties measured at measuring system 108 and optical properties, as described above, are not CD's.

With respect to paragraph 9 on the Continuation Sheet, Applicants in their previous Remarks were merely attempting to illustrate to the Examiner why the optical signals of Nakayama are not critical dimension measurements. With respect to Applicants' previous reliance upon the necessary inherency of a patterned photoresist layer, Applicants again were again illustrating that since a CD signal necessarily requires the measurement of a patterned layer and since Nakayama does not involve measuring patterned layers, Nakayama could not and does not teach a "CD signal." The feature of a "patterned" layer is not claimed because such is inherent in critical dimension.

With respect to the final paragraph that appears on page 2 of the Advisory Action, Applicants do not fully understand why the Examiner has pointed out that a trench is formed by etching and that a trench is a geometrical feature, since Nakayama does not disclose "trench". Applicants acknowledge that a trench has a depth in a direction normal to the surface. Trench depth generally bears no relation to film thickness, however, as trench depth is generally the depth into a substrate or layer that a trench extends. A trench cannot extend completely through a substrate and generally does not extend completely through a film layer. The unrelated fact that a film formed over a substrate has a thickness that is measured by Nakayama, does not transform an optical or thickness measurement into a CD measurement because a trench has a depth. If the Examiner is attempting to reason that since a trench is a geometrical feature and since a trench has a depth, that the thickness of an unpatterned layer becomes a critical dimension, Applicants respectfully disagree and point out that Nakayama does not disclose a trench. Applicants are unsure why the Examiner has chosen this line of reasoning but again point out that a "critical dimension" or "CD" is a term of art used to designate a width or spacing of a patterned feature.

Conclusion

In view of the foregoing amendments and remarks, Applicants submit that this application is in condition for allowance. Early notification to that effect is respectfully requested.

The Commissioner for Patents is hereby authorized to charge any fees required to give this filing effect or credit any excess payment that may be associated with this communication to deposit account **04-1679.**

Respectfully submitted,

Dated: 21 FEBRUARY 2007

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Attachments
http://www.semiconductorglossary.com/, as visited on 18 October 2006
http://www.sematech.org/publications/dictionary, as visited on 14 January 2007
Wolf, Silicon Processing for the VLSI Era, Volume 1, also attached, defines CD on page 532

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